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ABSTRACT

Pointing out a serious decline in the educational attainment of the nation's youth, this discussion of ways in which technology can begin to renew and improve education in American schools argues that, just as cable television and computer teleconferencing opened communication capabilities, the microcomputer presents unlimited possibilities for educators to enhance the educational climate as they prepare students for the 21st century. It is noted that the advent of the microcomputer presents the dilemmas of how and when to incorporate new technologies into an educational program, and describes several projects sponsored by the Office of Educational Research and Improvement (OERI) in the U.S. Department of Education to assist with these dilemmas. These projects include the teaching of science through such programs as the "Voyage of the Mimi," which combines educational television, microcomputer software, and printed materials in a multimedia approach; a series of school-based technology demonstration sites identified by OERI, including the Fairfax County School System (Virginia) which uses microcomputers to teach mathematics and problem-solving skills in grades 5-8 and science in grades 9-12, and plans to add word processing in grades K-12 and to provide additional teacher training in the use of microcomputers; the Computer Based Higher Order Thinking Skills (HOTS) Approach to Compensatory Education, which is a combined effort of the Glazier Elementary School in Norwalk, California, and the University of Arizona College of Education; NETWORK, Inc., which operates in several Massachusetts school districts to assist junior and senior high school English and content area teachers in developing, field testing, and evaluating a microcomputer-based program utilizing the software, QUILL, and designed to improve secondary student writing abilities; and the identification of and dissemination of information about exemplary programs through the National Diffusion Network (NDN). (DJR)

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"Technological Advances--New Opportunities for Educators"

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It is a great pleasure for me to join all of you here at the Regional Schools Contract Planning Committee State Conference.

I realize that this group gathered here represents the finest among educational leadership in the Commonwealth of Virginia. I have been a Virginia resident for fifteen years living in three different areas of the state and I think all Virginians can be proud of our educational system. We in Virginia are on the threshold of many new, substantive and innovative ideas in the field of education.

I particularly want to commend all of you for the choice of the theme of your conference this year "ITV in Virginia: New Needs and New Technologies." That theme says a lot. My keynote address follows on that very comprehensive theme: "Technological Advances: New Opportunities for Educators."

Over centuries, there have been many developments in education--the move from students gathered around the scholar to the classroom setting to groupings of classrooms we call school. There have been a variety of advances delivering educational services and assisting educators. Education took a great leap forward with development of printing, cheap paper, printing of books, the chalk board, various electronic devices such as the phonograph, radio, television and now the computer in the classroom.

Each introduction of technology brought with it certain excitement as well as opportunities and problems.

I recently had the opportunity to read through the "Annual Report of the Commissioner of Education" for the year 1931-1932. The Office of Education, if you can believe this, was then part of the Department of Interior. That report had the following comment on a new technological device for educators--radio.

The report (p.29) noted:

The Office of Education is called upon to answer a constant stream of inquiries on the vital subject of radio, which touches so many phases of life. From the remotest regions and from the cosmopolitan areas, from students, from advertisers, from editors, from those who serve and those who are being served, from reformers and from those who need reforming, questions pour into the Office of Education. The radio has captivated the imagination of the entire civilized world. It is stimulating a new revival of learning.

Noting that the Office of Education has responded to all the inquiries on education by radio, it added that it has gone beyond this by "assisting in setting up and evaluating broadcast programs of educational material" and also "initiated and assisted with certain research needed to make better use of radio as an educational agency."

We have come a far way since that report only about fifty years ago. We had the great experiment with educational television and now the computer in the classroom. We've gone from the passive mode of the radio (listening) and the television (listening and viewing) to the exciting world of the interactive nature of the computer.

I commend you for your focus on technology and education, and I will direct my remarks to some of the opportunities afforded educators by the onset of the "Information Age."

In many respects recent technological innovations have provided educators with both solutions to educational problems as well as creating dilemmas.

Many have been concerned about the quality of education in the public schools of our nation. The National Commission on Excellence in Education, which was appointed by U.S. Secretary of Education Terrel H. Bell, to

investigate and report on the condition of education in our nation, prepared a report, A Nation at Risk, which documented a serious decline in the educational attainment of our nation's youth. Other reports, which were released shortly after the Commission's report, also reported on alarming signs that something was wrong with education in America.

Problems within our schools must be confronted. It is, perhaps, in the technological arena that we can begin to renew and improve education in America. There are a myriad of problems which face educators; new technologies can help us as we attempt to solve many of these problems.

We can look to microcomputers to help us deal with specific learning problems, to ease the burden of overworked teachers enabling them more individualized time with their students. These, and other teaching/learning machines and devices, can enhance the educational climate of our schools.

Combinations of communications devices can be utilized with stimulating software to provide new and interesting ways of presenting information to students which will capture their attention, and spark their interest.

An excellent example of multi-media programming is the recently released Bank Street College project, The Voyage of the Mimi. Aired on television for the first time during September of 1984, the project received funding from the U.S. Department of Education, as well as the National Science Foundation. I'm pleased that the Office of Educational Research and Improvement was a prime mover in developing this outstanding program.

The focus of the 26-fifteen minute segments, which have integrated science and mathematics concepts into an adventure type format, are the adventures of two young scientists and their teenage assistants as they track whales from their seagoing research vessel.

Developed for the 8 to 12 year old age level, the Mimi series offers what could be referred to as "flexible components." Print and microcomputer software have been developed by a private sector publishing company. The software may be utilized on its own or in conjunction with the viewing of the television program. It consists of: a book, an overview teacher's guide, four modules with software, guides for the teacher and students for the modules.

This type of integrated use of technology may prove that educational television can be an additional asset to teachers. Television, and educational programming for television, has been with us for the last three decades, and yet most educators have been disappointed with its uses and applications as an educational tool. Perhaps rather than writing it off as a limited success and allocating its once bright promise to the back corner of the shelf reserved for yet another failed educational idea, its potential is only now beginning to be realized.

How fortunate those of us in education today are to be a part of the many new technological advances and discoveries which are taking place. We must always remember education is a journey, not a destination.

Many individuals tend to think of certain periods of history as being more exciting than present day society. I have heard individuals express interest in recapturing some of what might be referred to as the "adventure" of an earlier time. Well, make no mistake, these are times of adventure. We

are the pioneers of a new age-----as age which is now being referred to as the Information Age-----it is the dawn of a world characterized by new and innovative technological advances which will enable mankind to live and learn in ways in earlier times only envisioned in our imaginations; where the impossible moves into the realm of the possible and becomes reality. Our ability to perform wondrous achievements will be restrained only by our willingness or lack of willingness to make things happen.

Let not the view from our armchairs obscure the reality of our role as pioneers. The awesome task of incorporating these new technologies into our everyday lives is a responsibility that we all share.

The role in this process for educators is particularly crucial. We are the ones who must incorporate these new advances into our educational programs in a way that will prepare students now in school, the citizens of the 21st century, for the new technological age.

Some have expressed fears and concerns regarding the advances, and changes which are taking place; they suggest that we are about to enter a "brave new world" where the significance of the individual is diminished, and where the importance of the human being becomes secondary to the machine.

There is also the concern that we are opening the door for control by despotic tyrants. Science fiction films have portrayed this theme over and over again, popularizing the notion.

However, the lessons of history show a much different picture. The great dictators--Hitler and Stalin among them--have been those who were successful in controlling the sources of information within their societies and limiting the sources of information. What we now have before us is an explosion of, and access to information, unknown in past times; control by one tyrannical source is becoming very difficult.

Alvin Toffler, in an article entitled "The Data Deluge: Artificial Intelligence," published in Omni magazine (October, 1984) comments:

This much criticized homogenization of life was often attributed to technology: It was the machine that was depriving us of individualism.

He goes on to say:

The truly revolutionary fact of our time, however, is that the entire process of massification has now reversed itself. Rather than becoming more alike, we are breaking up the old mass structures and processes. Today's revolution is not just a matter of more or better machines; it is accompanied by a fundamental change in the underlying structure of society.

Whereas throughout the industrial past, the main thrust of change was toward greater homogenization, today we are rapidly moving toward "heterogenization."

An example which might reinforce this idea is the advent of cable television. It has greatly enhanced the dispersal of information. Prior to cable, television programming was basically controlled by the three major networks; very little choice was available. On cable television, we find programming especially targeted for children, stations with all sports, stations with all news, special services for the deaf, and some stations which even provide individuals with the opportunity to appear and speak on their personal opinions. There are also subscription educational services available on cable.

Taking the concept of the opening of communications capabilities one step further is a new dimension of computer teleconferencing or electronic networking. There is a system known as P.A.R.T.I. in which conferences between individuals go on for weeks, even months. One individual can key in on a subject of his choosing after which an exchange on that topic can begin.

We have a great many challenges as new horizons open up before us. There is an opportunity to utilize new technology, new machinery and equipment to enhance every individuals lifestyle in many and varied ways.

Life in the United States in 1984 would be very different even startling to Americans who were alive in 1874. I am certain that conditions here in 2074 will find everyday life with even greater and more dramatic changes.

Most of the developments which comprise "modern day life" occurred after 1870. The equipment, machinery, electronic devices which we rely on today, even considered necessities, have come into being since that time.

The idea for and early development of electricity (in lights and for radio), the automobile (mechanical transportation on the ground) and flight (mechanical transportation in the air) all took place in a relatively short period of fifty years 1870-1920. And just look at how far we have come in the past fifty years--from the report of the Commissioner of Education on radio captivating "the mind of the civilized world" to our present age of computers, computer literacy for kindergarten students and college by computer for students and adults.

Congressman Newt Gingrich of Georgia, one of the more innovative and creative thinkers in the United States Congress, has pointed out this startling discovery--the entire first flight of the Wright brothers airplane, from take off to landing, was no longer than the wing span of the present Boeing 747!

In a less than a century, we have gone from a primitive short flight to landing a person on the moon to sophisticated maneuvers in space. In 1950, a movie on a "Journey to the Moon" was no more than science fiction; less than 50 years later, that journey had been accomplished and space shuttles are becoming regular occurrences.

As we consider these developments of the past century and the ways in which man's lifestyle has been improved, it is easy to imagine that before 2084 has arrived many great and new developments will have taken place. In the next century, fantastic things are possible. We can expand upon our present day capabilities in a geometric rather than arithmetic fashion. We are entering a period where the impossible is really possible.

Rather than approach the exciting possibilities which exist for our society with fear and apprehension, we should see them as the positive reality they can become. We need to be opportunity oriented, not problem prone.

A moment ago, I mentioned Congressman Newt Gingrich. He has looked at the very positive side of the opportunities provided by the new technological developments in his recent book Window of Opportunity: A Blueprint for the Future. And through this window of opportunity, we explore some fascinating prospects.

For example, he suggests that the "Information Age" will most certainly mean a decline in 9 to 5 jobs, and the re-emergence of piecework. People who love freedom will rapidly adapt to working on their own schedules and being paid for the product on delivery creating an extremely fluid marketplace of skills and services.

Such a system will provide new opportunities for travel and individualism, a greater freedom in one's lifestyle but it will also require a lot of self-discipline.

Congressman Gingrich suggests:

Distance will evaporate as a limiting social factor when communication replaces transportation as the primary mode of human interaction. We already see geographic neighbors being replaced by electronic neighbors. Your best friend is probably not the person next door but a person you talk to on the phone.

The reality of commonplace travel in space is coming closer with and each new advance and it will probably not be uncommon for our grandchildren to "honeymoon on the moon". Gingrich also looks at potential developments in medicine and microbiology which have the potential for improving our health and longevity.

Is it possible that our early ventures into space will provide in addition to new sites for travel and vacationing a new life for the handicapped? A zero-gravity environment would give a paraplegic equal mobility with everyone else. The Georgia Congressman notes:

This is only one example of compassionate high tech. If given the opportunity, I am certain that our grandchildren will combine space flight, work under the oceans, computers, micro-electronics, and biotechnology to make the problems of disabling handicaps nuisances rather than life-shattering burdens. That future is no more amazing than the generation of 1870 would have found a world without polio, typhus, yellow fever, malaria, and cholera.

Unlimited possibilities! A bright and shining future! It can fire our imaginations with wonder and excitement. But turning all of these possibilities into a reality is a challenge which confronts today's educator. Today's educators are charged with preparing the adults of the 21st century for the world in which they will live. It is worth noting that this year's kindergarten class will be the college graduating class of the year 2000. The 21st century is already upon us.

Yet we should not ignore the dilemmas which face the classroom teacher and the curriculum specialist. When and how to incorporate new developments and new technologies into an educational program can be a difficult decision, and in many cases the teachers themselves are wary of utilizing equipment and/or information that may be new or unfamiliar to them.

Another problem is knowing what it is that is important for students to know. The advent of the microcomputer has raised many questions. What constitutes "computer literacy"? What courses should incorporate use of a microcomputer? How important is it for each student to be familiarized with a microcomputer? Should each student be given a special course? What about special computer languages such as "Logo"? Will they become obsolete as the computer equipment becomes more sophisticated?

Such problems and concerns should not, however, lull us into inaction. And sources of assistance are available. There are good programs, in place now, in many schools throughout the nation. That is why U.S. Secretary of Education, Terrel Bell made available 1.5 million dollars for awards to 12 school-based technology demonstration sites. The purpose of these demonstrations sites is to provide examples which other schools and/or school districts can follow.

Through this program, under the auspices of the Office of Educational Research and Improvement, we have identified excellent programs which are already being offered, and utilized successfully, in various local districts throughout the United States. Fairfax County Public Schools in Virginia received one of these awards. That school system will use its extensive array of micros to extend computer-assisted instruction to the upper grades, for example, teaching math/problem solving in grades 5-8 and science in grades 9-12. Part of their plan also includes adding word processing to the curriculum in grades K-12 and to provide additional teacher training in the use of micros.

The demonstration sites which were selected are representative of urban, suburban, and rural areas. Educators can look at these programs and see ways that they might be able to utilize technology in their own programs.

Some other examples are:

- o A Computer Based Higher Order Thinking Skills (HOTS) Approach to Compensatory Education. A combined effort of the Glazier Elementary School in Norwalk, California and the University of Arizona College of Education, the target population for the project are Chapter I students from culturally diverse backgrounds, grades K-6.

The purpose of the project is to test a new technology-based approach to compensatory education in the early grades (1-6). The goal is to break the cycle where large numbers of Chapter 1 students are turned off by traditional drill and practices. The program is designed to improve basic skills by creating fascinating computer-based environments which provide the young learner with the opportunity and motivation to apply basic concepts from the regular classroom in a more sophisticated, higher order thinking manner. Students in this program spend $\frac{1}{2}$ hour per day in a computer lab environment with computers, sophisticated peripherals, e.g., robots and color printers, and extensive simulation software. The carefully developed curriculum is based on learning theory and provides specific techniques for channeling student interaction with the computers into gains in basic skills and higher order thinking.

Another example is a program which has junior and senior high school English and content area teachers as its target population and operates in several school districts in the state of Massachusetts with the direction of the NETWORK, Inc.

- o Students in grades 7 through 13 are involved in this project which involves developing, field testing, and evaluating a micro-computer based program designed to improve secondary student writing abilities. The project

will utilize commercially available software, QUILL, as the basis for a comprehensive training and implementation program. The project integrates motivating, "real world" software tools with a teacher training program that emphasizes effective strategies for teaching writing.

Another program which stresses the importance of the sharing of information and ideas, and aids in the dissemination of information, is the National Diffusion Network.

The National Diffusion Network identifies exemplary programs and assists school districts in the adoption and implementation of these exemplary programs. It utilizes the knowledge of successful programs which can be used in other areas to bring the knowledge of good educational practices to other school districts and to avoid duplication of effort. We have been able to use the NDN network very effectively in assisting the technological revolution in the educational system.

The Secretary of Education, who has the authority to define areas of concentration for NDN, listed technology as one of the priority areas for this program. In the list of priorities, attention is given to computer science programs which aim to help students (1) understand the computer as an information, computation, and communication device; (2) use the computer to enhance instruction in English, mathematics, science, social studies, or for personal and work-related purposes, or (3) understand the world of computers, electronics, and related technologies. We have added new and innovative programs in technology to those available through NDN.

The Secretary designated that a number of schools utilizing technology successfully should be designated by the NDN as "lighthouse schools." These schools receive extra funding to train other educators with the expectation that their experience will be replicated in other parts of the country. The

response has been enthusiastic and satisfying. We now have eleven "lighthouse" schools with programs ranging from alternative occupation training in high technology for secondary school age students including some of whom had previously been high school dropouts (Project COFFEE, Oxford, Massachusetts) to more effective management of student records (Hopkins, Minnesota) to using technology to improve math and reading skills (Project HOSTS, Vancouver, Washington).

The Office of Educational Research and Improvement has taken a leading role in providing information and material on the revolution in technology in our schools.

We sponsored a conference on research issues for computer use in the fields of math, science, reading and writing at the University of Pittsburgh and Carnegie-Mellon University. That report Computers in Education: Realizing the Potential, published by the Government Printing Office, has become a classic in identifying critical issues.

The National Center for Education Statistics, a component of OERI, has published Computer Literacy: Definition and Survey Items for Assessment in Schools, a publication including a definition of computer literacy, a glossary of computer terminology, a bibliography of computer literacy, and a pool of questions on the use and application of computers in education. Another OERI component, the National Institute of Education has published a book Computer Education, a catalogue of technology projects supported by the U.S. Education Department. And, another component of OERI, the Center for Libraries and Education Improvement has published Alliance for Excellence: Librarians Respond to a Nation at Risk. This latter work

focuses on how librarians and information specialists can focus on the developments in this "Information Age" to make libraries more effective in relating to education and in creating the goal of a lifelong Learning Society, a recommendation in A Nation at Risk.

There are other print materials, and sources of information already available to teachers. Researchers and others who are involved with educational practices are aware of the difficulties teachers face as we enter the Information Age. Meetings and conferences such as the one you are currently attending can be a valuable aid in exploring the possibilities for schools.

We must not allow the complexities that face us to cause us to shrink back in fear. Educators can be certain of one thing as we enter the Information Age----education will be the hallmark of that new age. And that does not mean just one "formal" education but rather a lifetime of education. Up to the present decade, one education would prepare an individual for a lifetime in most careers. Today, most adults will require re-education, or re-training every 5 to 10 years----four or five re-educations throughout a lifetime.

Unfortunately, our society during the past decade has gone through a period of malaise--a period of hopelessness, psychological depression, a feeling that our problems outnumber available solutions, and the United States has passed its glory and is on some type of a historical decline. This pessimism, this doom-and-gloom, this retrenchment from exploring new frontiers has effected our educational system. We have been cast adrift without values, direction and goals.

Hopefully this situation is turning around as we discover the true measure of our civilization and the opportunities we have before us.

One of the most brilliant men of this century passed from the scene a short while ago. Herman Kahn had the ability and talent to conjure up the vision of the future based on current trends and development. In his last great work, The Coming Room, Dr. Kahn summoned up this vision and noted that although there are no guarantees having high technology and wealth will bring happiness, he did note that they both bring us two important things--improved security and more choices. We have improved security because affluence and advance technology give us the knowledge and ability to deal with whatever problems come up. We have a greater range of choices since we have greater opportunity for individual self-actualization and self-fulfillment as well as for national prestige and national ambition and with more paths to get there. He adds this comment which I believe all of us should mediate upon. Dr. Kahn states:

The kind of things we Americans, and much of the world as well, will be able to do in the year 2000 would have been associated with miracles or magic two hundred or three hundred years ago. It will be an exciting world--fulfilling and challenging--a world of opportunities, glamour, options.

All of you--by nature of your involvement in education--are in the forefront of not only helping to create that future world but of creating the vision of it and the talent to make it a reality in your students.